REMARKS

Claims 1 through 3, 6, 7, 16, and 17 have been previously canceled. Claims 4, 5, 8 through 15, and 18 through 20 remain in the application.

Claims 4, 8 through 14, and 18 through 20 were rejected under 35 U.S.C. § 103 as being unpatentable over Hirai et al. (U.S. Patent No. 5,734,364) in view of Stewart et al. (U.S. Patent No. 5,903,458). Applicants respectfully traverse this rejection.

As to patentability, 35 U.S.C. § 103 provides that a patent may not be obtained:

> If the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Id.

The United States Supreme Court interpreted the standard for 35 U.S.C. § 103 in Graham v. John Deere, 383 U.S. 1, 148 U.S.P.Q. 459 (1966). In Graham, the Court stated that under 35 U.S.C. § 103:

> The scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or non-obviousness of the subject matter is determined. 148 U.S.P.Q. at 467.

U.S. Patent No. 5,734,364 to Hirai et al. discloses a method of driving a picture display device. FIG. 5c shows the Hadamard's matrix of 7 rows and 8 columns. When (x)=(1, 1, . . . , 1), then, (y)=(7, -1, -1, .., -1) and the maximum displacement (the maximum value of .DELTA.y.sub.i is 8. Generally, the difference of the variation of the maximum voltages can be suppressed to a practically applicable extent by determining the above-mentioned reference vectors to be .DELTA.y.sub.MAX1 +.DELTA.y.sub.MAX2 <1.4.multidot.L (hereinafter, referred to as a condition C), more preferably, .DELTA.y.sub.MAX1

+.DELTA.y.sub.MAX.sub.2 .ltoreq.L (hereinbelow, refereed to as a condition D) where .DELTA.y.sub.MAX.sub.1 represents the maximum value of the difference of the variation of the column voltages to the reference pattern 1, and .DELTA.y.sub.MAX.sub.2 represents the maximum value of the difference of the variation of the column voltages to the reference pattern 2. Hirai et al. does not disclose modifying a surface of the mesh model by varying a predetermined parameter, wherein the surface is modified using direct surface manipulation (DSM) by defining a sketch plane containing a domain of a DSM feature, positioning the sketch plane relative to the surface of the model, locating a reference center within the domain, projecting a vertex located on the surface of the mesh model into the domain of the sketch plane, specifying a maximum displacement of the DSM feature by locating a reference vector centered at the reference center to define the height of the DSM feature in object space, specifying a basis function to determine a displacement of the vertex, determining a displacement of the vertex relative to the DSM feature using the basis function, and using the displacement of the vertex to modify the surface of the mesh model.

U.S. Patent No. 5,903,458 to Stewart et al. discloses a system and method for forming geometric features using global reparametrization scheme that allows the formation of DSM features which span multiple surface patches and reduce shape distortion. This scheme provides a single workspace common to the different surface patches thus obtaining a consistent, uniform parametrization. To eliminate the distortion caused by the spatial difference between the object space and parametric space, the common workspace is chosen as a plane residing directly in the object space. Different surface patches can then be reparametrized on the plane using a proper, consistent mapping procedure, thereby resulting in a uniform mesh of these surfaces. The mesh is ultimately substituted into the DSM method for the surface parametric space where DSM features are mapped. The shared workspace provides a common area to geometrically join

topologically disconnected surfaces patches through a uniform surface reparametrization. We call this shared workspace the super-mesh space. A point in this space is given in (u.sub.s,v.sub.s) Cartesian coordinates. Surface patch reparametrization in this space allows us to express surface patches of different UV domain in the same terms of (u.sub.s,v.sub.s) coordinates. Stewart et al. does not disclose modifying a surface of the mesh model by varying a predetermined parameter, wherein the surface is modified using direct surface manipulation (DSM) by defining a sketch plane containing a domain of a DSM feature, positioning the sketch plane relative to the surface of the model, locating a reference center within the domain, projecting a vertex located on the surface of the mesh model into the domain of the sketch plane, specifying a maximum displacement of the DSM feature by locating a reference vector centered at the reference center to define the height of the DSM feature in object space, specifying a basis function to determine a displacement of the vertex, determining a displacement of the vertex relative to the DSM feature using the basis function, and using the displacement of the vertex to modify the surface of the mesh model.

In contradistinction, claim 4 claims the present invention as a method for design of experiments using direct surface manipulation of a mesh model. The method includes the steps of selecting a geometric model, wherein the model is in a computer-aided design (CAD) format and converting the geometric model into a mesh model. The method also includes the steps of evaluating the mesh model using a computer-aided engineering (CAE) analysis and determining whether to continue generating the design of experiments response. The method includes the steps of modifying a surface of the mesh model by varying a predetermined parameter, wherein the surface is modified using direct surface manipulation (DSM) by defining a sketch plane containing a domain of a DSM feature, positioning the sketch plane relative to the surface of the model, locating a reference center within the domain, projecting a vertex located on the surface of

the mesh model into the domain of the sketch plane, specifying a maximum displacement of the DSM feature by locating a reference vector centered at the reference center to define the height of the DSM feature in object space, specifying a basis function to determine a displacement of the vertex, determining a displacement of the vertex relative to the DSM feature using the basis function, and using the displacement of the vertex to modify the surface of the mesh model. The mesh model is updated and the updated mesh model is used in continuing generating the design of experiments response, if determined to continue generating the design of experiments response. The method further includes the steps of using the results of the CAE analysis for the design of experiments. Claim 14 is similar to claim 4 and includes other features of the present invention.

The United States Court of Appeals for the Federal Circuit (CAFC) has stated in determining the propriety of a rejection under 35 U.S.C. § 103, it is well settled that the obviousness of an invention cannot be established by combining the teachings of the prior art absent some teaching, suggestion or incentive supporting the combination. See In re Fine, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 227 U.S.P.Q. 657 (Fed. Cir. 1985); ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 221 U.S.P.Q. 929 (Fed. Cir. 1984). The law followed by our court of review and the Board of Patent Appeals and Interferences is that "[a] prima facie case of obviousness is established when the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art." In re Rinehart, 531 F.2d 1048, 1051, 189 U.S.P.Q. 143, 147 (C.C.P.A. 1976). See also In re Lalu, 747 F.2d 703, 705, 223 U.S.P.Q. 1257, 1258 (Fed. Cir. 1984) ("In determining whether a case of prima facie obviousness exists, it is necessary to ascertain whether the prior art teachings would appear to be

sufficient to one of ordinary skill in the art to suggest making the claimed substitution or other modification.")

As to the differences between the prior art and the claims at issue, Hirai et al. '364 merely discloses a method of driving a picture display device using a Hadamard's matrix, a maximum displacement, and reference vectors. Hirai et al. lacks modifying a surface of the mesh model by varying a predetermined parameter, wherein the surface is modified using direct surface manipulation (DSM) by defining a sketch plane containing a domain of a DSM feature, positioning the sketch plane relative to the surface of the model, locating a reference center within the domain, projecting a vertex located on the surface of the mesh model into the domain of the sketch plane, specifying a maximum displacement of the DSM feature by locating a reference vector centered at the reference center to define the height of the DSM feature in object space, specifying a basis function to determine a displacement of the vertex, determining a displacement of the vertex relative to the DSM feature using the basis function, and using the displacement of the vertex to modify the surface of the mesh model. In Hirai et al. '364, the maximum displacement and reference vectors are used to drive a picture display, but does not use direct surface manipulation (DSM) by defining a sketch plane containing a domain of a DSM feature, positioning the sketch plane relative to the surface of the model, locating a reference center within the domain, projecting a vertex located on a surface of a mesh model into the domain of the sketch plane, specifying a maximum displacement of the DSM feature by locating a reference vector centered at the reference center to define the height of the DSM feature in object space, specifying a basis function to determine a displacement of the vertex, determining a displacement of the vertex relative to the DSM feature using the basis function, and using the displacement of the vertex to modify the surface of the mesh model.

Stewart et al. '458 merely discloses a system and method for forming geometric features using global reparametrization in which a mesh is ultimately substituted into a DSM method for a surface parametric space where DSM features are mapped and the shared workspace provides a common area to geometrically join topologically disconnected surfaces patches through a uniform surface reparametrization. Stewart et al. '458 lacks modifying a surface of the mesh model by varying a predetermined parameter, wherein the surface is modified using direct surface manipulation (DSM) by defining a sketch plane containing a domain of a DSM feature, positioning the sketch plane relative to the surface of the model, locating a reference center within the domain, projecting a vertex located on the surface of the mesh model into the domain of the sketch plane, specifying a maximum displacement of the DSM feature by locating a reference vector centered at the reference center to define the height of the DSM feature in object space, specifying a basis function to determine a displacement of the vertex, determining a displacement of the vertex relative to the DSM feature using the basis function, and using the displacement of the vertex to modify the surface of the mesh model. In Stewart et al. '458, the DSM method for the surface parametric space is used where DSM features are mapped, but does not define a sketch plane containing a domain of a DSM feature, position the sketch plane relative to the surface of the model, locate a reference center within the domain, project a vertex located on a surface of a mesh model into the domain of the sketch plane, specify a maximum displacement of the DSM feature by locating a reference vector centered at the reference center to define the height of the DSM feature in object space, specify a basis function to determine a displacement of the vertex, determine a displacement of the vertex relative to the DSM feature using the basis function, and use the displacement of the vertex to modify the surface of the mesh model. As such, there is no suggestion or motivation in the art to combine Hirai et al. '364 and Stewart et al. '458 together.

There is absolutely no teaching of a level of skill in the vehicle design art that a method for design of experiments using direct surface manipulation of a mesh model includes the steps of converting a geometric model into a mesh mode and modifying a surface of the mesh model by varying a predetermined parameter, wherein the surface is modified using direct surface manipulation (DSM) by defining a sketch plane containing a domain of a DSM feature, positioning the sketch plane relative to the surface of the model, locating a reference center within the domain, projecting a vertex located on the surface of the mesh model into the domain of the sketch plane, specifying a maximum displacement of the DSM feature by locating a reference vector centered at the reference center to define the height of the DSM feature in object space, specifying a basis function to determine a displacement of the vertex, determining a displacement of the vertex relative to the DSM feature using the basis function, and using the displacement of the vertex to modify the surface of the mesh model. The Examiner may not, because he doubts that the invention is patentable, resort to speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis. See In re Warner, 379 F. 2d 1011, 154 U.S.P.Q. 173 (C.C.P.A. 1967).

The Examiner admits on page 3 of the Office Action that Hirai et al. '364 fails to teach applying mathematical tools towards direct surface manipulation (DSM). However, the Examiner speculates that this is taught by Stewart et al. '458 because an improved direct surface manipulation method is disclosed which incorporates a global surface. Stewart et al. '458 discloses a DSM method for the surface parametric space where DSM features are mapped. Contrary to the Examiner's opinion, this DSM method does not teach defining a sketch plane containing a domain of a DSM feature, positioning the sketch plane relative to the surface of the model, locating a reference center within the domain, projecting a vertex located on the surface of the mesh model into the domain of the sketch plane, specifying a maximum displacement of the

DSM feature by locating a reference vector centered at the reference center to define the height of the DSM feature in object space, specifying a basis function to determine a displacement of the vertex, determining a displacement of the vertex relative to the DSM feature using the basis function, and using the displacement of the vertex to modify the surface of the mesh model. In this instance, the Examiner has adduced no factual basis to support his position that it would have been obvious to one of ordinary skill in the art to modify Hirai et al. '364 by way of Stewart et al. '458 to improve shape fidelity. The Examiner's stated conclusion of obviousness is based on speculation, unfounded assumptions or hindsight reconstruction to supply deficiencies in the factual basis.

The present invention sets forth a unique and non-obvious combination of a method for design of experiments using direct surface manipulation of a mesh model in which a mesh model is updated using Direct Surface Manipulation after a DOE parameter is varied, instead of updating the CAD model and converting the updated CAD model to a mesh model. The references, if combinable, fail to teach or suggest the combination of a method for design of experiments using direct surface manipulation of a mesh model including the steps of selecting a geometric model, wherein the model is in a computer-aided design (CAD) format and converting the geometric model into a mesh model, evaluating the mesh model using a computer-aided engineering (CAE) analysis, determining whether to continue generating the design of experiments response, modifying a surface of the mesh model by varying a predetermined parameter, wherein the surface is modified using direct surface manipulation (DSM) by defining a sketch plane containing a domain of a DSM feature, positioning the sketch plane relative to the surface of the model, locating a reference center within the domain, projecting a vertex located on the surface of the mesh model into the domain of the sketch plane, specifying a maximum displacement of the DSM feature by locating a reference vector centered at the reference center to

define the height of the DSM feature in object space, specifying a basis function to determine a displacement of the vertex, determining a displacement of the vertex relative to the DSM feature using the basis function, and using the displacement of the vertex to modify the surface of the mesh model, the mesh model is updated and the updated mesh model is used in continuing generating the design of experiments response, if determined to continue generating the design of experiments response, and using the results of the CAE analysis for the design of experiments as claimed by Applicants.

Further, the CAFC has held that "[t]he mere fact that prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification". In re Gordon, 733 F.2d 900, 902, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984). The Examiner has failed to show how the prior art suggested the desirability of modification to achieve Applicants' invention. Thus, the Examiner has failed to establish a case of prima facie obviousness. Therefore, it is respectfully submitted that claims 4 and 14 and the claims dependent therefrom are allowable over the rejection under 35 U.S.C. § 103.

Claims 5 and 15 were rejected under 35 U.S.C. § 103 as being unpatentable over Hirai et al. '364 and Stewart et al. '458 and further in view of Dehmlow et al. (U.S. Patent No. 5,999,187). Applicants respectfully traverse this rejection for the same reasons given above to claims 4 and 14.

Obviousness under § 103 is a legal conclusion based on factual evidence (In re Fine, 837 F.2d 1071, 1073, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988), and the subjective opinion of the Examiner as to what is or is not obvious, without evidence in support thereof, does not suffice. Since the Examiner has not provided a sufficient factual basis, which is supportive of his/her position (see In re Warner, 379 F.2d 1011, 1017, 154 U.S.P.Q. 173, 178 (C.C.P.A. 1967), cert. denied, 389 U.S. 1057 (1968)), the rejections of claims 4, 5, 8 through 15, and 18 through 20

are improper. Therefore, it is respectfully submitted that claims 4, 5, 8 through 15, and 18 through 20 are allowable over the rejections under 35 U.S.C. § 103.

Based on the above, it is respectfully submitted that the claims are in a condition for allowance or in better form for appeal. Applicants respectfully request reconsideration of the claims and withdrawal of the final rejection. It is respectfully requested that this Amendment be entered under 37 C.F.R. 1.116.

Respectfully submitted,

By: Daniel H. Bliss

Daniel H. Bliss
Reg. No. 32,398

BLISS McGLYNN, P.C.
2075 West Big Beaver Road, Suite 600
Troy, Michigan 48084
(248) 649-6090

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